SMALL FRUIT CULTURE

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A PAPER

READ BY

W. T. MACOUN

Dominion Horticulturist

BEFORE THE

STANDING COMMITTEE OF THE SENATE

ON

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W. T. Macoun

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The average farmer's home in Canada is not supplied with an adequate amount of small fruits, notwithstanding the ease with which they can be grown. It is a common thing to see a farmer on market day buying strawberries and other small fruits in the town to be taken home and treated as a luxury, when he should produce in his own garden all that he and his family could consume if they ate fruit three times a day. This state of affairs seems to be accounted for mainly by the fact that the farmer thinks he is too busy a man to have and care for a garden. If the farmers of this country only knew how much better they and their families would be with a plentiful supply of fruit they might make a greater effort than they do to raise enough for home consumption. There are some Canadian farmers, we are glad to say, who do have good gardens of both fruit and vegetables. The garden, which is usually on a well drained piece of land near the home, dries earlier than the fields, and can, therefore, be attended to before work begins in the field. A few hours' labour puts it in such shape that it can be cared for with comparatively little work during the summer.

With the following information to guide him, there is no good reason why every farmer should not have a fruit garden.

THE STRAWBERRY.

Strawberry Culture in Canada.

The strawberry is, we believe, the most popular fruit in Canada to-day. It ripens early in the season when every one is craving for fresh fruit, and where it can be readily obtained it is consumed in large quantities and with unabated relish until its season is over and the supply exhausted. The popularity of the strawberry is more general than that of some fruits from the fact that enough berries to supply the family needs may be grown on a very small area of land, hence it is possible for most people to grow strawberries if they desire to do so.

The strawberry is found wild from the Atlantic to the Pacific ocean in Canada, and from the southern boundary as far north as the 64th parallel, and large quantities of the fruits are gathered. The cultivated varieties are grown successfully almost everywhere where the wild species are found, but in some districts require protection

or irrigation. The season for ripe fruit opens early in June in southern Ontario and in parts of British Columbia. At Ottawa the first ripe fruit has been obtained on June 17, and the last picking of the latest variety was made on July 19. The season in the settled parts of the province of Quebec is somewhat similar to that at Ottawa, except along the lower St. Lawrence, where it is much later, the fruit not being ripe until about the first week of July, and the season continuing until the second week of August. The season on Prince Edward Island extends into August also. The strawberry season in all parts of Canada covers two months or more.

Culture: Soil and its Preparation.

If possible, the site for the strawberry plantation should be chosen where snow will lie in winter. A good covering of snow usually ensures a good crop of fruit. One of the most important requisites in a soil for strawberries is thorough drainage, as where water lies on or near the surface, the plants are sure to suffer either in summer or winter. While too much moisture is bad, too little moisture is unfavourable to the development of fruit, hence a soil should be retentive of moisture while not saturated with it. Warm soils, such as sandy loams, will produce early fruit, but friable clay loam will usually produce the best crops. Much, however, depends on the richness of the soil, as strawberries need abundance of available plant-food to give the best results.

Soil which will grow good crops of roots will usually grow good strawberries. A soil should be chosen, if possible, which does not bake naturally or which by thorough tillage may be brought into such good condition that it will not bake. It is difficult to keep the plantation free of weeds in soil that bakes, and it is also hard to conserve soil-moisture in a dry time.

Soil should be chosen, if possible, that has been prepared in a measure by growing a crop of roots which have been heavily manured. After the roots or other crops have been removed in the autumn, the land should be stirred deeply, it being a good practice to use a subsoil plough for this purpose. By using the subsoil plough the soil may be loosened to the required depth without bringing the subsoil to the surface, which would probably happen if it were ploughed very deep with the ordinary plough. Clover sod ploughed in the autumn is also good, as the sod furnishes humus, but grass sod land should be avoided, as there is great danger of injury from the white grub. In the spring the soil should be brought into good tilth with the harrows, and when it is thought best it may be ploughed beforehand.

The best fertilizer for strawberries is well-rotted barnyard manure, which should be used in large quantities. There need be little fear of using too much—thirty tons of well-rotted barnyard manure per acre being a fair application. It may be applied early in the spring before planting and thoroughly incorporated with the soil, or it may be used for a previous cultivated crop so as to get the soil clean and in the best condition for the strawberry plants. Fresh manure is not as satisfactory as manure well rotted, for it may make the soil too loose, causing it to dry out quicker and make the conditions bad for newly-set plants. On heavy soils, fresh manure may be used with better results than on lighter soils, but as there are likely to be many weeds grow if green manure is used, rotted manure is preferable even on heavier soils.

If fresh manure is used it will be better mixed with the soil before planting time, if it is applied in the previous autumn. Wood ashes are very useful for a top dressing, and from 50 to 100 bushels per acre may be applied broadcast early in the spring when the land is being harrowed, the larger quantity being used for land which is poor in potash. An application of even twenty-five bushels per acre should give beneficial results. If barnyard manure cannot be obtained easily, nitrogen and humus may be added to the soil by ploughing under clover, peas or some other leguminous crop; potash, by using from 200 to 300 pounds per acre of muriate of potash, if wood ashes cannot be obtained; phosphoric acid, by the use of ground bone, at the rate of from 200 to 300 pounds per acre before planting. Nitrate of soda is also useful for furnishing nitrogen, unless it can be obtained in a cheaper form by the use of barnyard manure or leguminous crops. An application of 100 to 150 pounds nitrate of soda broadcasted just before the flowers open in the spring is sometimes desirable if the plants are not making vigorous growth.

Plants and their Treatment.

If the plants for setting out are obtained from a distance, they should be ordered to arrive as early in the spring as possible after the soil can be worked, and planted soon after their arrival. It is often, however, not convenient to plant at once; but in any case, the parcel containing the plants should be opened up when it arrives, otherwise they are liable to heat or dry out, either one of which conditions should be avoided if possible. The plants should now be heeled in in some place where the soil is well drained. Open a trench sufficiently deep to cover the strawberries well and so that the crown will be just above the ground. Now place the plants close together, but in a single row in the trench. Another trench is now opened parallel with the first and about six inches from it, using the soil to cover the roots of the plants in the first trench. The soil should be firmly packed or tramped against the roots so that the moisture will come into close contact with them. If loosely heeled in, they are very likely to dry out and the plants die. Other trenches should be dug parallel with the first two, if needed. By the time the field is ready for planting, these heeled-in plants will have made new roots and be in better condition for planting than if they had been set out at once.

The best plants for autumn planting are what are known as 'pot' plants. These are obtained by sinking two and one-half inch pots filled with rich friable soil in the ground and placing a new runner in each of them. These root and make good plants by late summer. The advantage they have over plants rooted in the ordinary way is that when they are transplanted they are taken from the pot and replanted with a ball of earth without disturbing the roots. Hence they are but little checked and will soon go on growing again, making stronger plants, which will bear more fruit than the ordinary ones.

Before planting it is a good plan to remove all the large leaves of the plants except about two of the healthiest ones. This prevents too rapid transpiration of moisture from the plant before it becomes established and may often save it when dry weather sets in immediately after planting. Long and straggling roots may also be cut off at this time, the removal of about one-third of the roots being a good practice.

When possible one's own plants should be used, as they are much more likely to live than those procured from a distance, as the former can be dug and planted within a few hours while still fresh. The best plants to use are the strongest of those which have been made the previous year. Plants which have already fruited should not be used as they are much more difficult to transplant and their vitality has been weakened by the production of runners. It is a good practice, if it can be managed, to grow plants for setting in a special propagating bed, the old plants in which, not being allowed to fruit, make stronger runners and plants than do the fruiting plants. Furthermore, the extra attention to the cultivation of the soil and to the placing of the runners in such a bed will ensure good plants.

Planting.

Successful planting may be done either in the spring or autumn. Early in the spring, however, is the most satisfactory time, as, if the plants are set then, when the soil is in good condition and cool and moist, they will make rapid growth and many runners during the summer time, if properly looked after, and produce a full crop of fruit the following season. If planted in the autumn, there will be as a rule only a light crop of fruit the following season, and unless the weather is favourable and the soil is moist when the plants are set, there may be little growth. If planting is done late in the summer or autumn it should be as soon as the plants can be obtained with sufficient roots and when the soil is moist. The most satisfactory way for the average person to grow strawberries is in what is known as the matted row. The plants are set from fifteen to eighteen inches, or even more, apart in rows three and one-half to four feet apart. The varieties which make a large number of runners, such as Warfield, Senator Dunlap, and Splendid, need not be planted as closely as those which make fewer runners, such as Bubach, Buster, Glen Mary and Williams. If the plants are set early in the spring and have a long season for growth, the varieties which make a large number of runners may be planted twenty-four inches apart in the rows, thus admitting of cultivation both ways for a time, thereby reducing the number of weeds and ensuring better growth. As soon as the distances have been decided upon, the rows may be marked with a marker and then again cross-marked so that the plants may be set where the lines intersect. Long rows are desirable as, with them, time will be saved in cultivation. Planting may be done with a spade or with a trowel or dibble. When planted with a spade, two persons are required to do the work, usually a man and a boy. The man takes the spade and opens the hole by forcing the spade into the ground, pressing it forward and backward. As soon as it is withdrawn, the boy places a plant in position and the man presses the soil firmly against it with his foot. This method is very rapid and, if the soil is well pressed against the plant, is quite successful. A surer method of obtaining a stand is by using a trowel or dibble for opening the hole, whereby the plant is more likely to be set the proper depth, and more care usually exercised in spreading the roots and firming the soil about the plants. By this method, one person opens the hole and sets the plant. Great care should be taken to have the crown of the plant just at the surface of the ground after it has been pressed in when planted. If it is too high the crown will dry out, and if too low will be smothered. Care should be taken when planting to spread the roots against the sides of the hole. Planting machines are used by some

growers and give good satisfaction when the work is well done and the season favourable. If both perfect and imperfect varieties are planted there should be about one row of perfect to two or four of imperfect.

Cultivation.

As the value of the future crop will depend largely on the strength of the runners and new plants which are formed during the early part of the summer, it is very important to encourage rapid growth from the outset. Cultivation should begin as soon as possible after the plants are set, and the surface soil should be kept quite loose and free from weeds until the cultivator interferes with the runners. The early cultivations should be deep in order to loosen the soil in which the roots are to grow, and to warm and aerate it, making conditions for growth of plants as favourable as possible, but as soon as there is danger of injuring the roots of the plants, cultivation should be shallow. Hoeing will be necessary occasionally in order to destroy all weeds and loosen the soil close to the plants. All blossoms which appear during the first season should be pinched off so as to reserve the strength of the plants for production of runners. Most varieties make far more runners than should be allowed to remain, and, if one is making a specialty of strawberries or wishes to get the finest berries, the best plan is to place the runners so that they will root more quickly, and to destroy all those which are not required in following the system which has been decided to adopt. In the prairie provinces, where winds prevent the prompt rooting of runners, it is important to hold them in place until they root with pieces of sod, stones, an inverted crotch or by any other suitable method.

Forming the Row.

The best way to grow strawberries for general culture is in the matted row. By this method labour is economized and the results, while sometimes not as good as where special methods are adopted, are obtained with the least expense and the greatest profit. Where a special market is to be catered for and when desired for home use, strawberries may be grown by other methods which will result in larger and finer fruit.

While many who grow strawberries in the matted row do not take the trouble to place the runners as they form, it pays to do so, as the sooner they take root the stronger the plants will be by autumn and more fruit will be produced the next season. All that is necessary is to place the runners so that they will be as nearly uniformly distributed as possible in order to economize space, and to put a little soil over them to hold them in place, at the same time leaving the terminal bud bare. When treated in this way they will root quickly. To get the best results, runners should not be nearer than from four to six inches apart, all others being destroyed; but in practice it is often difficult to accomplish this and to restrict them to this area, as some varieties make a great many runners. These are, however, the kinds which have most need of thinning, as, when the plants are very thick, the fruit is too small. The width of the row formed by autumn will depend on the number of runners which are made, but if planted early, and properly cared for, most varieties will make a row two feet wide. At this width there would be a path eighteen inches wide left for the

pickers between the rows. As some varieties would cover the whole space between the rows with runners in one season, it is necessary to remove those not wanted with the cultivator or hoe.

The so-called single hedge and double hedge row systems are merely modifications of the matted row. The runners, instead of being allowed to form indiscriminately, are most of them removed and the rest placed where it is desired for them to grow. In the single hedge row system, two to four runners are left on, and these are placed in line with the row on each side of the parent plant.

When grown in this way the rows are two and one-half to three feet apart and the original plants about two feet or more apart in the rows. When the row is formed, the plants are six to eight inches apart in a single row.

In the double row system, six runners are left to each plant in the row and two on each side of the original row, all about equal distances apart. Trained in this way, the original rows should be about three feet apart and the plants two feet or more in the row.

The twin hedge row system provides for two rows sixteen to eighteen inches apart with the plants at first about two feet apart in the row, with a wider space of two feet for a path and for cultivation between each pair of rows. The hedge row system requires considerably more labour than the matted row, but the returns will often well pay the grower for the extra amount of work. By this method the plants get more opportunity to develop strong crowns, better cultivation can be given and more of the plant food in the soil will be available, resulting in larger and better fruit.

Hill System.

Large berries may be obtained by growing the plants by what is known as the 'Hill System.' The plants are set from twelve to fifteen inches apart, in rows two to two and one-half feet apart; the blossoms are pinched off the first season as in the other system and no runners are allowed to form. By this method a very strong crown is developed; the plants, having more room, become vigorous and as a result the fruit is large, and sometimes as good crops are obtained as from the matted row.

However, winter injury is much more likely to occur when plants are grown individually, and if plants grown in hills die from heaving or from some other form of winter-killing they leave large blanks, causing a great lessening of the crops. Unless kept well cultivated or well mulched in summer, plants suffer more in a dry time in hills than in the matted row, where the crowns are better protected by foliage. If the plants are kept well mulched, very fine fruit is produced when strawberries are grown in hills, which sometimes makes this method preferable when growing strawberries for home use.

Winter Protection.

After permanent frost has set in and the ground is quite solid, the plants should be covered with a light coat of clean straw, that which will not pack closely over the plants being the best, marsh hay being very good and free from weed seeds. This mulch will prevent the alternate thawing and freezing of the ground in the spring and protect the plants if there is not much snow in winter. A heavy mulch may cause

heating in the spring before it is removed, and as a light mulch of two or three inches is sufficient, more should not be used. It has occasionally been recommended to grow something between the rows of strawberries during the latter part of summer, which could be used to hold the snow in winter, but this is not a desirable method as, while growing, it exhausts the moisture from the soil at the expense of the strawberry plants. In those parts of Canada where the flowers are frequently injured by spring frosts it is desirable to hold them back as long as possible, and for this purpose, after the first heavy fall of snow, the snow is covered with straw or evergreen boughs, which are left on as long as possible in the spring. While plants will often come through the winter without protection it is best not to take any risks. After the frosty weather of early spring is over and before the plants begin to grow, they should be uncovered and the straw put between the rows to keep the fruit clean. If the soil is one which bakes or dries out easily, it is a good plan to remove the mulch, cultivate, and put it back between the rows when conditions will be better for conserving moisture. As soon as the fruit has been picked the straw should be removed altogether, the plantation ploughed up, or, if left for another season, it should be weeded and the surface soil loosened with the cultivator so that the new runners will have a chance to root.

Renewing the Plantation.

The most satisfactory results are obtained when only one full crop is gathered from a plantation. If, for instance, plants are set this spring, the plantation should be ploughed up after the fruiting season of next year. There will thus be a new plantation made every year. By this system, much better fruit is obtained as the plants are not so thick in the row and the soil can be kept freer of weeds. Where the white grub is troublesome, it is important to renew the plantation every year, as this pest increases rapidly in old plantations and sometimes almost ruins the crop. It is quite possible to obtain two good crops or even more from a plantation by careful management, but the older the plantation the less the crop will be and the smaller the fruit, as a rule.

Renovating an Old Bed.

While as a rule the most profitable method of growing strawberries is to take only one crop from a plantation, and at the most two crops, it is sometimes not practicable to renew small plantations after the second crop.

Under such circumstances there are several ways in which the bed may be improved. Usually an old bed is grown up with grass and weeds and crowded with strawberry plants, and to improve the bed these must be reduced as much as possible. As soon as the fruit is off, the leaves and grass should be mown off and burned. One plan is to plough or dig down the middle of the row, then thoroughly cultivate or rake. Another method is to narrow the row on each side to a width of 8 to 12 inches, turning the soil towards the row. Still a third plan is to plough lengthwise through the centre of the row, then cross-plough. It is necessary in following any of these methods to level the soil afterwards with the harrow, cultivator or hoe. Usually the work is finished with the hoe by cutting out all surplus plants and bringing the soil about those remaining, which will give them better conditions for making roots. It

should be remembered, when renovating the bed, that it is not necessary to leave many plants. Plants left sixteen to twenty inches apart should make a good row by autumn. Those left should be the youngest and strongest. It is a good plan when renewing, to work in some short rotted manure to improve the soil.

Irrigation.

During the fruiting season the strawberry needs a large supply of moisture to give maximum crops. In some seasons, owing to dry weather, the crop is reduced very much, the season is shortened and the profits are small. If, under those conditions, there were available a supplementary supply of water which could be used for irrigating, a marked improvement in the crop would be ensured in many cases.

Varieties.

It occasionally happens that a person who has a variety of strawberry which yields much better with him than other varieties which he has growing alongside, concludes to discard all other kinds and grow that one variety. He does so, and is disappointed to find that he has very few berries, and these ill-shaped and worthless. He does not know what to think about it, but writes to the Experimental Farm to learn what is the matter. The reply is sent back: 'Are you aware that the flowers of strawberries may be perfect or imperfect, or bisexual and pistillate; in other words, do you know that some varieties of strawberries produce blossoms which have both male and female organs, while other varieties have only female organs? If you do not, the solution of your difficulty is very easy.'

The male and female organs in plants perform the same functions as in animals. The fine dust formed on the stamens, which is shed when the flower is in bloom, is the fertilizing agent, which falls on the pistil and fertilization takes place. If the stamens are absent, or nearly all absent, as is the case in imperfect or pistillate flowers, no fruit, or very little fruit, is formed. If a perfect, or bisexual flowering variety, and an imperfect flowering variety are growing in close proximity, the flowers on both will be fertilized as insects and the wind carry the pollen or dust from the perfect to the imperfect flowers. It very often happens that the imperfect flowering varieties produce the best crops when properly pollinated, and this experience may lead fruit growers who are ignorant of the foregoing fact to the mistake of planting only one variety, which may be imperfect.

A row of a perfect flowering sort should be planted to about every two to four rows of an imperfect variety for good results. The proportion will depend on the amount of pollen produced by the perfect sort. Of course, it is not necessary to plant an imperfect variety at all, as there are plenty of good sorts which have perfect flowers. It is essential to have the perfect and imperfect varieties in full bloom at the same time, as, if the former bloomed before the latter, there would be no object in planting it as a pollinator.

Owing to the ease with which a new variety of strawberry is originated, and the short time it takes to fruit the same, the number of new sorts each year in America is very large. Only a small proportion of those which are produced are better than

[illegible] appear to those which are already on the market, but often the originator is not the most competent person to judge the relative value of his seedling, and as a result many new sorts are offered for sale each year. It is the work of the Experimental Farm to test these new varieties as they appear, and having compared them with standard sorts, publish, when deemed advisable, a reliable description of them and the yield obtained. During the past twenty-one years, 596 named varieties have been tested at the Central Experimental Farm. Of this number only 14 are still under test of those grown during the first two years. This does not mean that nearly all the varieties tested at first have deteriorated, but that better kinds introduced have taken their places.

Varieties of Strawberries Recommended.

There are so many varieties of named strawberries introduced each year that the list of those recommended has to be changed from time to time, as those of superior merit are found.

The following are those which are recommended at the present time:—

Commercial.—Beder Wood (per.), Splendid (per.), Warfield (imp.) not suited to light soil, Williams (per.), Senator Dunlap (per.), Greenville (imp.), Bisel (imp.), Sample (imp.), Buster (imp.). Pocomoke (per.), and Parson's Beauty (per.), are also two very good commercial berries. In British Columbia, the Magoon (per.), is one of the best.

Domestic.—Excelsior (per.), Splendid (per.), Senator Dunlap (per.), Lovett (per.), Ruby (per.), Bubach (imp.), Wm. Belt (per.).

Some yields obtained at the Experimental Farm, Ottawa, from two matted rows each sixteen feet in length and three and one-half feet apart, were the following: The average yield per acre of Pocomoke for two years was at the rate of 9,412 lbs. and Sample 8,841 lbs.. These are not exceptionally large yields, as the highest yield obtained at the Central Experimental Farm was from the Greenville in 1901, that variety yielding at the rate of 14,818 lbs. per acre.

Hardiest Varieties.

There have been some severe winters experienced at the Central Experimental Farm during the past twenty-one years, which have made it possible to learn which varieties are the hardiest. The injury to flowers from frost in the spring is often considerable, as strawberry flowers are very sensitive to the cold, hence it is important in some districts to know which have the hardiest flower buds. Among the hardiest varieties it has been found that the hardiness of the plant is usually correlated with hardiness of flowers, although the late blossoming sorts are less likely to suffer than the early ones. Following are some varieties which have proven hardiest: Beder Wood, Lovett, Senator Dunlap, Pocomoke, Crescent.

English Varieties.

Many English varieties of strawberries have been tested at Ottawa, but they have all proved too tender to be grown commercially or even for home use. The English

sorts have been originated in a climate quite different from that in most parts of Canada, hence it is not a matter of great surprise that they are too tender. The best varieties of American origin have to withstand severe winters before they are recognized as valuable for general culture. In Great Britain and Ireland the plants are not subjected to such trying conditions and become popular for other reasons, hence when they are subjected to the frosts of winter and heat and dry weather of summer in Canada, they fail to succeed well. As a rule, English varieties make few runners and hence are not as well protected by their foliage for extremes of temperature in winter or in summer as the best American sorts. Of those which have been tested, the Champion of England, Noble, and Albert appear the hardiest. The best English varieties are better in quality than the best American berries, but some of the most profitable kinds in England are not the best quality. The average variety there, however, is much sweeter and of higher flavour than those in Canada, but although the flavour is higher one misses the sprightliness in some varieties which is characteristic of Canadian strawberries. The Royal Sovereign is the most popular variety in England. The Wm. Belt, Marshall, Brunette, and some others compare favourably in quality with the best English sorts, but unfortunately they are not the most productive.

Causes of Poorly-shaped Berries.

There are two causes of poorly-shaped berries or nubbins. The commonest is unfavourable weather conditions. The flower and growing fruit are very susceptible to injury from cold winds or cold weather. Sometimes part of the berry is injured, while another part being, perhaps, more protected, escapes and develops normally. Another cause of poorly-shaped fruit is lack of pollination. The supply of pollen is either deficient in the fruit itself, or there has not been enough brought by wind and insects to pollenize all the stigmas of the berry. Extremely dry, hot weather may injure the pollen. Rainy weather during the blossoming season may cause much poorly-shaped fruit by preventing proper pollination. The remedy is to plant varieties with abundant pollen and mix these with any imperfect sorts which may be grown. Keeping the plants back as much as possible in the spring, by not removing the mulch early, will help to avoid injury from cold winds and frost.

Description of Varieties Recommended.

Bubier Wood (Per.) Form round conical, medium size, pale red, not prominent seeds; flesh pale, juicy, acid, moderately firm, medium quality; season early to extra early, plant vigorous; runners numerous; foliage moderately good; rusts considerably. Promising on account of earliness, productiveness and for being a good pollenizer.

Beeri (Imp.) Roundish, large; bright red, handsome with rather prominent seeds; flesh bright red, juicy, inclined to be hollow, briskly subacid, moderately firm, above medium quality; mid-season; plant vigorous; runners numerous; moderately good, but rusts considerably.

Buster (Imp.) Roundish, large; bright rather pale red, not prominent seeds; flesh bright red, juicy, briskly subacid, moderately firm; of medium to above medium quality, season medium late to late; plant vigorous with medium number of runners;

foliage good but rusts considerably. Very promising. As firm as Clyde and brighter red. Keeps its size well to the end of the season. Foliage is good and shades the fruit well.

Babach (Imp.).—Irregular wedge conical, very large; bright red, seeds not prominent; flesh bright red, juicy, subacid, moderately firm to firm, good quality; season medium to late; plant vigorous, runners medium in number, foliage moderately good, but rusts slightly to considerably.

Excelsior (Per.).—Roundish conical, medium to above medium in size; deep glossy red, not prominent seeds; flesh bright red, juicy, briskly subacid, firm, above medium in quality; season early to extra early; vigorous, runners numerous; foliage good but rusts considerably.

Glen Mary (Per.).—Irregular, roundish to wedge conical, very large to large; deep red at base becoming pale towards tips, seeds not prominent; flesh bright red, juicy, rather watery; subacid, firm, of medium quality, medium season, moderately vigorous, runners numerous; foliage moderately good to good; rusts considerably.

Greenville (Imp.).—Roundish to wedge shaped, large to very large; bright red; flesh bright red, juicy, subacid, pleasant, moderately firm to rather soft; good quality; vigorous, runners numerous; foliage good, rusts slightly to considerably.

Lovett (Per.).—Pointed to wedge conical, above medium size; bright red, glossy, flesh bright red, juicy, acid, moderately firm, and above medium in quality; season early to medium; vigorous, few runners; poor to moderately good foliage, rusts considerably to badly. An attractive productive berry.

Parson's Beauty (Per.).—Fruit obtusely conical, above medium to large in size; bright red, glossy, prominent seeds; flesh bright red, juicy, tender, subacid, firm; above medium quality; season medium late; plant vigorous, large number of runners; foliage moderately good, rusts slightly to considerably.

Poconoke (Per.).—Fruit obtusely conical, large to very large; bright glossy red inclined to have white tips, seeds rather prominent; flesh bright red, juicy, tender, briskly subacid, very firm; above medium quality; season medium late; plant vigorous, large number of runners; foliage moderately good, rusts considerably to badly.

Ruby (Per.).—Obtusely conical, medium to above medium in size; deep scarlet; seeds medium; flesh rich red, juicy, subacid, good flavour; quality good; medium late season; firm; plant vigorous; numerous runners; foliage healthy.

Sample (Imp.).—Fruit pointed conical, very regular in shape; above medium to large; bright or rather deep glossy red, seeds fairly prominent; flesh bright red, juicy, almost watery, subacid, moderately firm; medium quality; season medium to late; plants vigorous, large number of runners; foliage moderately good to good, rusts considerably.

Senator Dunlap (Per.).—Fruit pointed, wedge and long wedge conical, necked, medium to large in size; deep glossy red, seeds not especially prominent; flesh rich red, juicy, tender, briskly subacid, moderately firm; above medium quality; season early; plants vigorous, large number of runners; foliage moderately good, rusts considerably.

Splendid (Per.).—Fruit roundish, medium to large, deep red, seeds not prominent; flesh red, juicy, acid, moderately firm; above medium quality; early to medium

season; plants vigorous, numerous runners; foliage moderately good, rusts considerably to badly.

Warfield (No. 2) (Imp.).—Pointed conical, medium to above medium size; deep red, glossy, rather prominent seeds; flesh deep red, juicy, acid, moderately firm; medium quality; early to medium season; plants vigorous, large number of runners; foliage moderately good, rusts considerably to badly. A handsome berry and a good cropper.

Williams (Per.).—Wedge conical large; bright, rather deep red with a white tip, rather prominent seeds; flesh bright red, juicy, subacid, good flavour, firm; quality good; medium season; plants vigorous, large number of runners; foliage moderately good, but considerable rust.

Wm. Belt (Per.).—Irregular, first fruit wedge shaped, others wedge and pointed conical, large; bright red, seeds fairly prominent; flesh bright red, meaty, juicy, subacid, good flavour, firm; very good quality; season late; plants vigorous, with a large number of runners; foliage moderately good to good, but rusts considerably to badly.

Insects and Diseases Affecting the Strawberry.

There are comparatively few insects and diseases which cause serious injury to the strawberry, and in this paper only the most important are described. The information in regard to insects has been taken mainly from the reports and other publications of the Entomologist and Botanist of the Dominion Experimental Farms, and that on diseases from the bulletin on Strawberry Culture prepared by the writer.

White Grub.—The white grub often does much damage in strawberry plantations, and sometimes gives the fruit-growers a great deal of trouble. If, however, the life-history of this insect is known and proper methods followed, it may be controlled. The method is to take only one crop of fruit from a plantation and then plough it up, thus preventing the insect from passing through all its stages and so destroying it. Land for strawberries should be prepared by growing some crop that the white grub will not touch, and thus offering them no inducement to stay in the soil.

As the growing of other crops, which the white grubs are fond of, near the strawberries may be the means of introducing them to the strawberry plantation, the following description of the life-history of this insect as given by Dr. C. Gordon Hewitt, Dominion Entomologist, will be useful in controlling them: –

'These insects in the adult stage are known in the south as the May bugs. In the north they are called the June bugs, as this is the month of the year when the insects themselves are flying around. The white grubs are found in natural grass land and when such land is put under cultivation the white grub attacks the subsequent crops in a similar manner to the wireworm, and it is on such crops that the greatest injury is effected. Sometimes the white grubs are in such large numbers that they will frequently destroy whole patches of natural grass, and you sometimes find whole lawns destroyed by the presence of these white grubs, which feed on the roots. Not only do the grubs themselves feed on the roots and grass, but their parents, the adult beetles, are also injurious. In Europe the June beetle frequently occurs in such numbers that clouds of them fly across the country and eat up everything before them, almost like locusts. The adult insect feeds chiefly on the foliage of hardwoods such

as the oak, maple, chestnut, willow, ash, etc., and it is extremely fond of feeding on apple trees, especially nursery stock. The adult insect is, therefore, just as much a menace as its larva, the white grub. The insects usually appear in this part of the world in June, as their name implies, and they generally fly at night. Frequently in June you will see a very large insect flying about and sometimes it will bang heavily against you; such an insect is generally a large June bug, or as it is called in other parts of the world, the cockchafer. They feed upon the foliage of trees, and shortly afterwards deposit their eggs in the ground singly at a depth of an inch to three inches. The larvæ or white grubs hatch out, and first they feed on the young and tender roots of the crop, whether it is strawberry, oats, wheat or other cereal crops, and on the approach of winter they go deeper into the ground and pass the winter in the grub stage. The white grub, like the cut-worms, has a life-history which extends over several years, generally about three years. The greatest damage is done during the second year, and in some cases during the third year, when the larva feeds upon the larger roots; it is then that it begins to make its presence noticeable. It spends, as I have said, two or three years in the soil, and then goes deeper down into the soil and makes a hollow cell or chamber in the earth, where it changes into a pupa, as we call it.'

Strawberry Weevil.—The strawberry weevil frequently does much harm by cutting off the flower buds, the stem being severed close to the bud. The grub of this insect feeds on the pollen of the flowers, and after the female has laid an egg in the bud she cuts off the latter so that it will not develop. The unopened bud falls to the ground and the grub of the weevil develops inside it. There is only one brood of this insect in the year. The beetles appear in August and then hide away beneath the moss or among the bushes, and remain in a lethargic condition until the following spring. The varieties of strawberries chosen by the female for egg-laying are those which produce much pollen, as it is chiefly on that part of the flower that the grubs feed. Varieties of strawberries which are bearers of pistillate flowers only are not attacked; consequently when the strawberry weevil is abundant, growers will do well to plant a large proportion of pistillate sorts, only using enough plants of perfect flowering sorts as will ensure proper fertilization of the fruit.

As the strawberry weevil passes the winter in the mature beetle form, and flies to the strawberry buds just before the flowers unfold, when the work of the weevil is noticed in the spring, it would be well where it is practicable, to cover the rows of perfect-flowering plants with cheesecloth until the flowers are well opened. Trapping the beetles, it is claimed, has produced good results. For this purpose, pollen-bearing plants should be planted in rows near the bearing beds, and when these are found to be covered with beetles, the plants may be sprayed with whale-oil soap solution, one pound in five gallons of water, or with the kerosene emulsion.

Cut-worms.—Cut-worms sometimes do much injury in the strawberry plantation, especially the climbing species. They do their destructive work at night, and though the injury to the roots or leaves is apparent in the morning, the cut-worms have disappeared. They may usually be found secreted in the surface soil not far away from the plants they have injured.

Remedy.—Where either the climbing or the non-climbing species is troublesome, or where injury is done to either leaves or roots, the most effective remedy is poisoning

with a mixture of bran and Paris green, in the proportion of one-half pound of Paris green to fifty pounds of bran. The bran is slightly moistened before the Paris green is added so that the latter will mix better with it. This poisoned bran, of which the cut-worms are very fond, is scattered on the surface of the ground about the plants.

Leaf Blight. Rust.—This disease does much injury to some varieties of strawberries by reducing the healthy leaf-surface and so lessening the vigour of the plants. When thus weakened, the plants are unable to develop fruit properly, the crop is much lessened and the quality of the fruit is poorer. Fewer and fewer runners are also made. Some varieties are much more affected than others and, where this disease is troublesome, those should be chosen which are least affected by it. This information is given in the description of varieties published in this paper. It has been noticed that strawberries are more affected by the leaf blight when grown on sand loam than on clay.

The first indication of this disease is the appearance of round, purplish or reddish-brown spots on the leaves during the summer. By the close of the picking season, and often in the middle of it, these have become very numerous. The spots, which are at first small, also increase rapidly in size and often coalesce, thus involving a large proportion of the leaf, which finally withers. As the spots increase in size, the centres become white, and from this white portion are given off myriads of spores which are carried to other leaves and plants, thus propagating the disease. Later in the season, winter spores are developed from the same spots, but these are carried over winter in small sacs which are attached to the leaf. These sacs do not permit the spores to escape until spring, when they cause the first infection.

Bordeaux mixture will check this trouble if thoroughly applied. In order to control the disease it is necessary to begin spraying just when the leaves unfold in the spring, to destroy the winter spores. A second spraying should be made as soon as the bloom has fallen, a third immediately after the fruit has been picked, and, if possible, a fourth later on. New plantations should be sprayed during the growing season at as frequent intervals as are necessary to keep the foliage covered with the mixture.

Some growers burn the foliage as soon as the picking season is over. The foliage is mowed off and then fired. An experiment was tried at the Central Experimental Farm to test the value of this method, twenty-nine varieties being burned, while a similar area of the same varieties was not burned. It was found that when there was an extra amount of litter lying on the rows, the crowns of the plants were somewhat injured by burning. The aftergrowth of the plants burned over was luxuriant and healthy, but rust soon developed. At the close of the season, however, the sprayed plants were much healthier than those un-prayed. In small plantations, a good plan would be to mow the foliage, and after raking it off burn it in piles where there would be no chance of injury to the plants.

Powdery Mildew of the Strawberry. The disease known as powdery mildew is not common in this country, but in one locality in Ontario, at least, it has done considerable harm and, as it may soon spread, it should be referred to here. When this disease is bad it covers the fruit with mildew, making it unfit for sale or consumption. The grower does not usually notice the disease until it affects the fruit, but as a rule it starts on the underside of the leaves, which eventually curl up, and in order to

control it, it must be treated early, as the plants cannot be sprayed satisfactorily when the fruit is developing, although ammoniacal copper carbonate might then be used. For spraying the foliage, Bordeaux mixture may be used, or flowers of sulphur in the proportion of one part lime and two parts flowers of sulphur. It is important that the underside of the leaves should be well covered, and even the soil, so that spores may be destroyed. These are scattered early in the spring from the tiny sacs in which they are contained during the winter. They soon germinate and attack the leaves. As this disease spreads only on the surface of the leaves, it is readily controlled if treated at the proper time.

COST OF GROWING ONE ACRE OF STRAWBERRIES

(6,000 boxes).

Rent of land (2 years)	$10 00
Preparation of land	4 00
Fertilizers	30 00
Plants	36 00
Planting	5 00
Cultivation	15 00
Mulching	10 00
Boxes	21 00
Picking	60 00
Crates and marketing	25 00
	$216 00
Selling 6,000 boxes at 5c. per box	300 00
Net profit	$84 00

NOTE.—The crop may be much larger or it may be smaller, and the price obtained for the fruit will be higher in many cases than the estimate made in this table, while in the districts where fruit is produced on a larger scale the prices may be lower.

THE RASPBERRY.

The raspberry is the most popular bush fruit in Canada. Beginning to ripen just as the strawberry season is over, a supply of this fruit can be kept up for three or four weeks in the hottest part of the summer, when, owing to its refreshing character, it is very much appreciated when eaten raw with cream and sugar, and is used in this way in large quantities. Not only is the raspberry popular in the raw condition, but it is very generally used for canning and preserving. Raspberries, when made into 'raspberry vinegar' make a very refreshing drink which is especially appreciated in the country.

Soil.—The red raspberry succeeds best in a deep, rich, loamy, cool, moist soil. On light soils and in soils which are liable to dry out in summer the crop will be much lessened in a dry time, and the growth of canes will not be strong, and hence the crop will suffer the next season.

The blackcap raspberry will succeed better on light soils than the red raspberry, and it will not do at all well in cold soil. It needs a warmer soil than the red raspberry.

Plants.—The raspberry grows from the same root year after year, although on different canes. The canes which grow one year bear fruit the next and then die and new ones take their place. In the case of red raspberries the best plants for a new plantation are the suckers which spring up around or near the old plants in the spring. These are allowed to grow throughout the season and then dug up and planted out early in September after the ground becomes moist, or planted early in the spring. Plants should be cut back to within six or eight inches of the ground at the time of transplanting. The blackcap and most of the purple-cane raspberries do not make suckers as do the red, but they multiply by tips. Long slender growths are thrown out shortly after the fruiting season is over. In nature where they are more or less protected these take root, but in the open field where they are exposed to wind it is necessary to hold the tips down with a little soil, when they will soon root. The plants are left until late fall or early spring, when they are dug up. If ordered from a distance, tips which have had a year's growth are the best for planting. Care should be taken not to plant blackcaps too deep. If the roots are covered with more than two inches of soil they are liable to rot.

Preparation of the Soil. The better the soil is prepared before planting the better the results will be. Deep ploughing and liberal manuring are important. A hoed crop the previous season will help to make good conditions for rapid growth. If the subsoil is hard it should be loosened to enable the roots to get down where there is a regular supply of moisture, which is important in dry weather.

Planting, Cultivating, and Pruning. The suckering varieties of raspberries should be planted in rows six feet apart and three feet apart in the row, or another good method is to plant them in hills five feet apart each way, when they may be kept cultivated both ways. As it is important to have a perfect stand, a good plan is to set two plants close so that there will likely to be at least one grow. The plants of sucker-

ing varieties are set four or five inches deep. Blackcaps are planted about the same distance apart but shallower as stated before. As soon as possible after planting the ground should be cultivated and the surface should be kept loose by frequent cultivations during the summer as strong growth is important, and this can only be assured by good cultivation, but at the end of the second season the canes may be reduced to four or six of the strongest. Suckers are cultivated or hoed out. There will be a little fruit the year after planting, but not until the year after that will there be a fair crop of fruit from which time the plantation should bear good crops of fruit for six to eight years.

The main pruning of suckering varieties consists in cutting out dead and superfluous canes, leaving four to six of the strongest for fruiting. This may be done either in the autumn or spring. If canes are to be covered for protection in winter, which is desirable where they are liable to be killed, they are grown to a height of four to six feet. Where they are not protected the canes are usually headed back when they have reached a height of fifteen to twenty inches, laterals then grow and a very stocky plant is the result. These laterals are cut back from twelve to fifteen inches either in late fall or spring. Where actual comparisons have been made summer pinching has not given as satisfactory results as when the canes are let grow their natural length and the slender tips merely pinched off in the spring. In colder districts these laterals are liable to be injured by winter.

The canes of blackcap raspberries should be cut back each season when they have reached a height of two to two and a half feet, as unless this is done they are difficult to manage. By pinching back the plant becomes stocky and throws out laterals. The laterals may be cut back to a length of twelve to fifteen inches in the autumn, but it is better to leave them until spring, when if there is any injured wood it may be removed at the same time.

Pinching back in summer is attended with some risk in certain sections, especially if not done in good time as after pinching back the young growth sometimes grows too late, causing winter killing. The best plan is to head back to the desired height in the spring.

Protection in Winter.—In some parts of Canada some varieties of raspberries do not succeed very well unless the canes are protected in winter. This is readily done by bending down the canes just before winter sets in and holding them down by a little soil on the tips. To bend and cover them without breaking, a little soil is taken out on one side of the hill, the canes are then collected in a bunch, pressed down in the line of the row by means of a fork in the hands of one man while sufficient earth is applied by another man to hold them down. The cost of the labour involved in covering an acre should not exceed $5. When protected in this way canes will come through the winter in good condition, when if unprotected they are badly injured. On the prairies, best results are obtained when the canes are entirely covered with soil.

Fertilizers.—An annual application of well rotted barnyard manure will help to keep the soil rich, which is necessary if good crops are to be obtained.

Varieties of Raspberries Recommended.

For General Culture—

Red, early.—King, Brighton, Count, Marlboro.
Main crop.—Cuthbert, Herbert.
Yellow.—Golden Queen.
Purple.—Columbian, Shaffer.
Blackcaps.—Hilborn, Older, Gregg, Smith Giant.

For Home Use—

Red.—Herbert, Sarah, Clarke, Heebner.
Yellow.—Golden Queen.
Purple.—Columbian.
Blackcaps.—Hilborn, Older, Gregg, Smith Giant.

Hardiest Varieties.

Red.—Herbert, Sarah, Turner, King, Loudon, Sunbeam.
Yellow.—Golden Queen.
Blackcaps.—Hilborn, Older; Cumberland and Gibraltar of the newer varieties are promising.

The crop of raspberries, like most other fruits, depends largely on climatic conditions, and even though the best variety is planted, if the season is unfavourable or the plantation has not been cared for properly, the yield will be much lessened. As a rule it will be found that the more the crop can be increased by special care the greater the profits will be, the extra labour and expense made being much more than repaid for by the increased crop and additional revenue. A crop of raspberries, according to Bailey, ranges from 50 to 100 bushels per acre. Card found that the average yield of red raspberries estimated from the information received from 56 growers is about 69 bushels per acre. At the Central Experimental Farm the average yield of the Herbert raspberry for two years on one row 90 feet in length was at the rate of more than 205 bushels per acre, or about 6,586 lbs. From two rows, each 18 feet in length, or one row 36 feet long, the average yield for three years was over 229 bushels per acre, or 7,357 lbs. The average yield of the Brighton from two rows each 18 feet in length was over 175 bushels per acre, or 5,692 lbs. The highest individual yield was obtained from the Herbert in 1904, which produced 50 lbs. 12 ozs. of fruit from two rows each 18 feet in length, or one row 36 feet long, which is at the rate of 10,294 lbs. per acre, or 319 bushels 26 lbs., estimating a bushel at 32 lbs.

While these large yields are from small plots, they show the possibility of increasing the average yield throughout the country very much.

THE BLACKBERRY.

The blackberry is a native of the Eastern States, and in Canada it is found from Nova Scotia westward and northward to near the Manitoba boundary.

The commercial culture of blackberries in Ontario and Quebec is confined mainly to southwestern Ontario. In the Lake Huron district, where there is a heavy fall of snow, blackberries succeed very well, but when unprotected by this covering in winter they are not satisfactory. They are grown with varying degrees of success in other parts of these provinces, the amount of protection they get in winter usually governing the results obtained. At Ottawa there is rarely a good crop of blackberries, as there is not quite enough snow as a rule to protect them well, and the canes are injured. Blackberries do exceptionally well in [illegible] Colony, and also succeed in parts of the Maritime Provinces.

Propagation.

The blackberry is one of the easiest fruits to propagate. The suckers, which are produced in great numbers, may be used, or if one wishes to propagate a variety even more rapidly than by suckers, it may be increased from root cuttings. The roots are cut up into pieces two or three inches long. They may either be made in the fall or in the spring, and then planted in nursery rows about three inches deep for one season, at the close of which if the soil is well cultivated there will be good plants available.

Soil, Planting and Culture.

The blackberry ripens its fruit at a trying time of the year, as in late July or August there is often hot, dry weather, and if there is not a good supply of moisture in the soil the fruit will dry up, and what has promised a big crop will result in only a few good berries. In selecting a soil, therefore, one should be chosen which will retain moisture well. As the blackberry is inclined to grow late in the fall, and on this account is more tender than the raspberry, soil should be chosen which although rich in plant food has not an excess of nitrogen, which would be liable to induce late growth. Hence bottom land should be avoided in most places, as such is likely to be rich in nitrogen.

One of the best soils for blackberries is a good upland clay loam. In such soil there is likely to be sufficient plant food without an excess of nitrogen, making conditions favourable for the development of the crop and ripening of the wood. The soil should be well prepared as for all other bush fruits, and a good application of well rotted barnyard manure to most soils will be found desirable.

Spring planting is usually preferable. If planted early in the autumn the young plants are liable to start growth and the new shoots to be injured by the frost, hence if planted in the fall they should be set late. Strong one-year old suckers are the best to plant.

Blackberries require a great deal of space to develop properly and to give an opportunity of cultivating and picking them. The rows should not be less than eight feet apart, with the plants about three feet apart in the rows. The quickest way to plant is to open deep furrows eight feet apart which cross a light mark every three feet. At each intersection of the rows the plant is set a little deeper than it was last so and the soil thrown against it and well pressed against the roots. Where the soil is well prepared, planting may be done very quickly by opening a hole with a spade when the soil is lightly marked both ways.

If especially fine fruit is desired a good method of planting is to set the plants about eight feet apart each way and keep them in hills. By this method cultivation may be maintained both ways, and the plants having a better opportunity to develop will bear finer fruit.

Good cultivation should be given the first year to get the plants well established and to procure a strong growth early in the season. When the plants are eighteen inches to two feet in height they should be pinched off to make them throw out side shoots and thus keep them the better within bounds. All canes except three or four of the strongest should be cut out. The second year the new shoots made that season should be pinched back when between eighteen inches to two feet in height, and as they will not all be the same height at the same time, it is necessary to go over the plantation several times. It is important to do this work in good time, as if done too late the laterals will grow too late and be injured by winter. During the second season five or six of the strongest canes should be left, and all the rest should be removed either during the summer or in the autumn.

This practice is then followed every year, the canes which have borne fruit being removed as soon after fruiting as it is convenient to do the work. Each spring the laterals should be headed back considerably, the length of lateral to be left depending on the variety, as some kinds set fruit further out on laterals than others. Until the fruiting habit of the varieties is known the laterals should not be headed back until the flower buds show. The length of lateral to leave after pruning will vary considerably, but there should not be more than two feet left. If it has not been possible to pinch in summer, and no pinching is better than pinching too late, the bushes may be headed back to three or four feet in height in spring, and the laterals headed in as already described.

The pinching back in summer tends to keep the bushes lower than they otherwise would be, and they are thus more protected in winter, but they may be still more protected by bending them over and covering the tips with soil to hold them in place, although this is very unpleasant work, and it scarcely pays to do it if blackberries are grown for sale.

The conservation of moisture is very important in growing blackberries, and as the fruit does not ripen until late in the summer, cultivation will be later than for most fruits. It will be usually found best to continue cultivating until the berries are almost ready to pick.

A blackberry when it is perfectly ripe, is one of the finest fruits, but if picked before it is ripe is quite unfit for use. Unfortunately some varieties become black before they are fully ripe and are picked too soon, and frequently blackberries are picked before they are well coloured, the result being that they reach the market in an unripe condition, and it is not to be wondered at that those who try them in this condition do not wish to use blackberries again. It would be in the best interests of their business if fruit growers would pay more attention to this matter, and only ship fruit which will be in good condition when it reaches the consumer.

A blackberry plantation is in full bearing the third season after planting, and will continue profitable for a long time if well cared for, but it is usually best to renew the plantation every eight or ten years.

Yields of Blackberries.

The blackberry is a more uncertain cropper than the currant, gooseberry and raspberry, as it suffers more in winter and is affected more by dry weather in summer. No really good crops of blackberries have been produced at Ottawa, the best yield being in 1895, when the Agawam yielded at the rate of 2,452 boxes per acre. The next best yield was in 1903, when the Agawam yielded at the rate of 1,979 boxes per acre.

Bailey, in his Horticulturist's Rule Book, gives the yield at from 50 to 100 bushels per acre, which at 32 lbs. to a bushel is from 1,600 to 3,200 lbs.

Varieties of Blackberries Recommended.

Agawam, Snyder, Eldorado; and for southern sections, Kittatinny.

Diseases and Insects.

Anthracnose or Raspberry Cane Rust.—Anthracnose has seriously injured raspberries in many parts of Canada during recent years. So serious is the injury in some places, and so difficult is it to eradicate, that growers have become discouraged and have given up the culture of this fruit. This disease first makes its appearance when the young shoots are from twelve to fifteen inches in length, and is recognized by the brownish or purplish patches or depressions upon the young shoots and leaf stalks. As the shoots grow, the blotches become larger and greyish in the centre, and by the end of the season may encircle the cane and practically girdle it. The plant suffers most during the second season, when the disease has usually spread so much that a large portion of the canes and smaller stems are affected and moisture is cut off from the fruit, thus preventing its proper development and often causing the cane to die. This disease reproduces itself by spores in summer which are scattered by wind and rain. The disease is supposed to pass through the winter by means of the mycelium of the fungus in the intercellular spaces of the cane.

Poor success usually attends any attempt to control this disease by spraying, although some experimenters claim to have obtained good results. The best results have been obtained from spraying by beginning with Bordeaux mixture before the leaves open in the spring, giving a second spraying soon after the young canes appear above the ground, the young canes being thoroughly covered with the mixture. A third spraying is made about two weeks after the second, paying special attention to the young canes. A fourth spraying should be made just before blooming.

Fruiting canes should be cut out and burned immediately after fruiting. Healthy shoots should, if possible, be obtained from another source when making a new plantation, and these planted on different soil.

Anthracnose is usually worse in neglected plantations, hence raspberries should be well cared for and the canes kept thin in the rows, as if there is a good circulation of air there is less likely to be injury from this disease.

Red Spider.—In dry years great injury is occasionally done in plantations of raspberries, currants and gooseberries, as well as on apples and many other kinds of

fruits, by various species of spinning mites which are usually spoken of in a general way by horticulturists under the name of 'Red Spiders.' These are all very minute reddish, or greenish white, mites that are found on the lower surfaces of the leaves, which they cover with a fine network of web in which they live and which renders it very difficult to get at them with ordinary liquid applications. These minute creatures propagate very rapidly, and their injuries to plants by sucking out the juice of the leaves is very soon apparent by the bleached appearance of the foliage, which soon dries up and falls away.

Remedy.—It is probable that most kinds of red spiders pass the winter as eggs on the bushes. Plantations which have been infested one year should be thoroughly sprayed early in the spring with the lime-sulphur wash. Sulphur has a specially fatal effect upon all kinds of mites. If bushes are found to be infested in spring or summer time, they should be sprayed forcibly with kerosene emulsion, which might be followed in persistent attacks, which often occur, by dusting the bushes while wet with powdered sulphur by means of one of the so-called insect guns or horticultural blowers.

THE CURRANT.

The currant is not so generally used in Canada as some other fruits, as few persons care for them when eaten raw, and when cooked they are usually made into jelly and consumed by only a comparatively small proportion of the people. In the colder parts of Canada where other fruits do not succeed well the currant is more popular and is used much more generally. It is a wholesome and refreshing fruit and deserves much more attention than it gets at the present time.

Soil.

Currants should be planted in rich soil in order to get the best results. The soil should also be cool as the currant is a moisture loving bush. The currant roots near the surface, hence if the soil is hot and dry the crop will suffer. A rich well-drained clay loam is the best for currants, although they will do well in most soils. If the soil is not as good as it might be it should receive a good dressing of manure before planting, which should be well worked into the soil, the latter being thoroughly pulverized before planting is done. A northern exposure is to be preferred, as in such a situation the currants are not likely to suffer in a dry time.

Planting.

The best time to plant currants is in the autumn. If planted in the spring they will probably have sprouted somewhat before planting, and on this account their growth the first season will be checked. Where the soil is in good condition currants, especially the black varieties, make strong growth, and the bushes reach a large size, hence it is better to give them plenty of space as they will do better and are easier

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picked than if crowded. Six by five feet is a good distance to plant. If planted closer, especially in good soil, the bushes become very crowded before it is time to renew the plantation. Strong one-year old plants are the best, but two-year old plants are better than poorly rooted yearlings. It is better to err on the side of planting a little deeper than is necessary, than to plant too shallow. A good rule to follow is to set the plants at least an inch deeper than they were in the nursery. The soil should be well tramped about the young plants to prevent danger of it drying out. After planting the soil should be levelled and the surface loosened to help retain moisture.

Cultivation.

As the currant, to do well, must have a good supply of moisture, cultivation should be begun soon after planting, and the surface soil kept loose during the summer. While the plants are young the cultivation may be fairly deep in the middle of the rows, but when the roots begin to extend across the rows, cultivation should be quite shallow, as many of the roots are quite near the surface.

Fertilizers.

After the first application of manure no more should be necessary until the plants begin to fruit, unless other crops are grown between, when an annual top dressing of well rotted barnyard manure is desirable. When only a light application of manure is given, the addition of two or three hundred pounds per acre of muriate of potash should be very beneficial. Wood ashes also make a good fertilizer with barnyard manure. There is little danger of giving the currant plantation too much fertilizer. Unfortunately it is usually the other way, this fruit being often very much neglected. When in full bearing currants should be fertilized every year.

Pruning.

The black and red currants bear most of their fruit on wood of different ages, hence the pruning of one is a little different from the other. The black currant bears most of its fruit on wood of the previous season's growth, hence it is important to always have a plentiful supply of one-year old healthy wood. The red and white currants produce their fruit on spurs which develop from the wood two or more years of age, hence it is important in pruning red and white currants to have a liberal supply of wood two years and older, but as the fruit on the very old wood is not so good as that on the younger, it is best to depend on two and three year wood to bear the fruit. A little pruning may be necessary at the end of the first season after planting in order to begin to get the bush into shape. From six to eight main stems, or even less, with their side branches will, when properly distributed, bear a good crop of fruit. Future pruning should be done with the aim of having from six to eight main branches each season and a few others coming on to take their places. By judicious annual pruning the bush can be kept sufficiently open to admit light and sunshine. A good rule is to not have any of the branches more than three years of age, as if kept down to this limit the wood will be healthier, stronger growth will be made and the fruit will be the better.

When to Renew the Plantation.

A currant plantation will bear a great many good crops if well cared for, but if it is neglected the bushes lose their vigour in a few years. The grower will have to decide when to renew the plantation by the appearance of the bushes, but as a currant plantation can be renewed at comparatively little labour it is best to have new bushes coming on before the old ones show signs of weakness. At least six good crops may be removed with fair treatment, and ten or more can be obtained if the bushes are in rich soil and well cared for. Where one has only a few bushes for home use they may be reinvigorated by cutting each of them down to the ground in alternate years, and thus obtaining a fresh supply of vigorous young wood.

RED AND WHITE CURRANTS.

The red currant makes excellent jelly, and its popularity is largely due to that fact. A large quantity of red currant jelly is made every year in Canada. Red currants are used to a lesser extent for pies and as jam, and are also eaten raw with sugar. As a fruit for eating out of hand the red currant is not very popular, but there are few fruits so refreshing and if it had less acidity more red currants would be eaten that way. The white currants are better liked for eating off the bush than the red as they are not so acid. The Moore Ruby and Early Scarlet are two red varieties, however, which are milder than most others, and for this reason are better adapted for eating raw than most. The red currant does not vary as much in quality as the black.

Red currants will remain in condition on the bushes for some time after ripening, hence do not have to be picked as promptly as the black.

Varieties of Red and White Currants Recommended.

Red—For general culture.—Pomona, Victoria, Cumberland Red, Red Dutch, Greenfield, Rankins' Red, Red Grape.

Where bushes are protected with snow in winter, and for the milder districts.—Pomona, Victoria, Cumberland Red, Wilder, Cherry, Fay and Red Cross. Perfection is promising.

White.—White Cherry, Large White, White Grape.

It is possible that under different conditions of soil and climate other varieties might do equally well.

BLACK CURRANTS.

There are not so many black currants grown in Canada as red, but there is a steady demand for them, and it is believed there will be an increasing demand as they become better appreciated. The black currant makes excellent jelly, and the merits of black currant jam have long been known.

Varieties of Black Currants Recommended.

Saunders, Collins Prolific, Buddenborg', Victoria.

Of those not yet on the market which are considered equal to or better than those above, the following are the best:—

Kerry, Eclipse, Magnus, Clipper, Climax and Eagle, and the Success for an early variety where yield is not so important as size and quality.

Topsy is very handsome and of good size and good quality, and ripens evenly, but has not been quite as productive as some others. Boskoop Giant is promising.

Propagation.

The usual method of propagating currants is by means of cuttings. These root very readily and good plants are obtained after one season's growth. The best time to make the cuttings is in the autumn, as currants begin to grow very early in the spring, and once the buds have swollen they cannot be rooted successfully. Wood of the current season's growth is used. This may be cut early in the autumn as soon as the wood has ripened, at Ottawa from the end of August to the middle of September being a good time. They should be cut in as long pieces as possible, to save time in the field, and put in a cool, moist cellar or buried in the sand. If the cuttings can be made at once it is best to do so. These are made by cutting the wood into pieces each about eight to ten inches long, although an inch or two more or less is not of much consequence. The base of the cutting should be made with a square cut below the last bud. There should be at least half an inch of wood left above the top bud of each cutting, as there should be a strong growth from the upper bud, and if the wood is cut too close it is liable to be weakened. A sloping cut is best for the upper cut as it will shed rain better, but this is not important. When made, the cuttings should be planted at once, which is usually the best plan, or heeled in. If heeled in they should be tied in bundles and buried upside down in warm, well-drained soil, with about three inches of soil over them. The object of burying them upside down is that by this method the bases of the cuttings will be nearer the surface where the soil is warmer and there is more air, and they will callous quicker than if they were further down. The cuttings should callous in a few weeks, and they may then be planted outside if thought advisable. Cuttings may be kept in good condition over winter by heeling in or burying in the sand in a cool cellar, or after callousing under a few inches of soil outside they may be left there over winter if covered with from four to five more inches of soil to prevent their drying out. Good results are obtained with the least trouble by planting the cuttings in nursery rows as soon as they are made. The soil should be well prepared and should be selected where water will not lie. Furrows are opened three feet apart and deep enough so that the top bud, or at most two buds, will be above ground. The cuttings are placed about six inches apart in the smooth side of the furrows and soil thrown in and trampled well about them. Where only a small number are to be planted a trench may be opened with a spade.

Yield of Currants.

The red currant is one of the most regular bearing of all fruits, and as it is naturally productive the average yield should be large. Bailey, in the Horticulturist's

Rule Book, puts the average yield at 100 bushels per acre. Card, in Book on Bush Fruits, makes it 100 to 150 bushels, with a possible yield of 320 bushels per acre. At the Central Experimental Farm the Raukins' Red, the largest yielder, averaged for four years at the rate of 8,107 lbs., or over 202 bushels per acre. The Red Dutch averaged at the rate of 7,355 lbs. per acre, or over 183 bushels. The largest yield from red currants obtained at the Central Experimental Farm was in 1900, when six bushes of the Red Dutch currant yielded 73 lbs. 15 ozs. of fruit. The bushes were six by five feet apart. This means a yield at the rate of 17,892 lbs. per acre, or at 40 lbs. per bushel, 447 bushels 12 lbs. per acre. The same variety in 1905, in a new plantation yielded 55½ lbs. from six bushes, or at the rate of 13,431 lbs. per acre, or 335 bushels 31 lbs. These are very large yields, and while half of this amount may be expected in ordinary field culture, the fact that such yields can be produced on a small area should be an inspiration to get more on a larger one.

The average yield of black currants has been somewhat less than the red, although individual yields have been large. The Saunders currant in an average of four years yielded at the rate of 6,382 lbs. per acre, or over 159 bushels. The highest yield of black currants was obtained in 1905, when six bushes of Kerry planted six by five feet apart yielded 62 lbs. of fruit, or at the rate of 15,004 lbs. per acre, equal to 375 bushels, estimating at 40 lbs. to the bushel.

Diseases and Insects.

The currant is affected by very few diseases. The only ones which do much injury are the following:—

Leaf Spot, Rust.—The Leaf Spot fungus affects black, red and white currants, causing the leaves to fall prematurely, and thus weakening the bushes. This disease is first noticed about midsummer, when small brownish spots appear on the leaves. These often become so numerous that they affect a large part of the foliage; soon it is difficult to control it if the bushes are not sprayed until after the fruit is picked, except by using the ammoniacal copper carbonate a week or two before the leaf spot is expected. This will not discolour the fruit, and a second application may be given if necessary. As soon as the fruit is picked the bushes should be thoroughly sprayed with Bordeaux mixture. Experiments have shown that this disease can be controlled by spraying.

Currant Anthracnose.—This disease which may be mistaken for the Leaf Spot, affects different parts of the bush, including the leaves, leaf stalks, young branches, fruit and fruit stalks. On the leaves it may be evident during the month of June by the small brown spots, which are usually smaller than those made by the Leaf Spot fungus. The lower leaves are affected first and finally the upper ones. They turn yellow and gradually fall to the ground, and when the disease is bad the bushes are defoliated before their time. On the petioles or leaf stalks the disease causes slightly sunken spots. The fruit is affected with roundish black spots, which are easier seen when the fruit is green. On the young wood the diseased areas are light in colour and are not so noticeable.

The wood is not nearly so much injured by the disease as the leaves. The spores which spread this disease are formed in pustules, the majority of which are under the upper epidermis of the leaf. Where the spores are to appear the surface of the leaf is

raised and blackened in spots looking like small pimples. When the spores are ready to come out the skin breaks and they escape and reinfect other parts. When the foliage drops early on account of this disease the fruit is liable to be scalded by the sun. The fruit may also wither before ripening properly owing to lack of food or moisture, as the leaves, having fallen, are unable to keep up the necessary supply. The premature falling of the leaves prevents the bushes from maturing properly, hence they are not in as good condition to bear fruit the next year.

Spraying with Bordeaux mixture is recommended as an aid in controlling this disease. It would be wise, where currant anthracnose is troublesome, to spray the bushes thoroughly before the leaves appear. A second spraying should be made when the leaves are unfolding, and successive sprayings at intervals of from ten to fifteen days until the fruit is nearly full-grown, or there is danger of it being discoloured by the spray when ripe. Paris green should be added to the mixture when the first brood of currant worms appear. A thorough spraying after the fruit is harvested is desirable.

Currant Aphis.—When the leaves of currant bushes are nearly full grown, many of them bear blister-like elevations of a reddish colour, beneath which will be found yellowish plant-lice, some winged and some wingless. The blisters are due to the attacks of these insects, and when, as is sometimes the case, they are very abundant, considerable injury is done to the bushes.

Remedy.—Spraying forcibly with whale oil soap solution or kerosene emulsion will destroy large numbers of these plant-lice at each application, but the liquid must be copiously applied and driven well up beneath the foliage by means of an angled nozzle. Two or three applications at short intervals may be necessary.

Currant Maggot.—Red, black and white currants in British Columbia and in several places in the prairie provinces, in recent years, have been seriously attacked by the maggots of a small fly. These maggots come to full growth just as the berries are about to ripen, causing them to fall from the bushes, when the insects leave them to burrow into the ground to pupate. Attacked fruit is rendered useless by the presence of maggots inside the berries; and frequently it is not until the fruit is cooked that the maggots can be detected. Gooseberries are sometimes injured, but far less frequently than red and black currants.

Remedy.—The only treatment which has given any results is the laborious one of removing about three inches of the soil from beneath the bushes which are known to have been infested, and replacing this with fresh soil. That which was removed must be treated in some way, so that the contained puparia may be destroyed. This may be done either by throwing it into a pond or by burying it deeply in the earth.

Currant Worm or Imported Currant Sawfly.—By far the best known of all the insects which injure currants and gooseberries is the 'currant worm.' The black spotted, dark green false caterpillars of this insect may unfortunately be found in almost every plantation of currants or gooseberries every year in almost all parts of Canada. The white eggs are laid in rows along the ribs of the leaf on the lower side, towards the end of May. From these the young larvæ hatch and soon make their presence known by the small holes they eat through the leaves. Unless promptly destroyed, they will soon strip the bushes of their leaves, thus weakening them considerably so as to prevent them ripening fruit the first year, and also reducing the

quantity of the crop the following season. There are at least two broods in a season in Canada. The first appears just as the leaves are attaining full growth, and the second just as the fruit is ripening. The perfect insect is a four-winged fly which may be seen flying about the bushes early in spring. The male is blackish, with yellow legs, and of about the same size as a house fly, but with a more slender body. The female is larger than the male and has the body as well as the legs yellow.

Remedy.—For the first brood a weak mixture of Paris green, 1 ounce to 10 gallons of water, may be sprayed over the bushes, or a dry mixture, 1 ounce of Paris green to 6 pounds of flour, may be dusted over the foliage after a shower or when the leaves are damp with dew. For the second brood, Paris green must not be used, but white hellebore; this is dusted on as a dry powder, or a decoction of this powder, 1 ounce to 2 gallons of water, may be sprayed over the bushes. It is, of course, far better to treat the first brood thoroughly, so as to reduce the number of females which would lay eggs for the second brood.

THE GOOSEBERRY

The gooseberry has received comparatively little attention in America, although in north Europe, and especially in the British isles, it has long been a prime favourite, and a wonderful improvement has taken place in its size during the last two or three hundred years. When it was first cultivated in Europe—probably in the 16th century—the wild fruit, if it was like what it is now, would be only about one-half an inch in diameter and less than one-quarter of an ounce in weight. The largest gooseberries which have been produced in recent years average several times this size, the largest one of which we have a record weighing two ounces, although there are doubtless larger specimens on record. The English and European gooseberries are derived from a species of native or north Europe, called *Ribes Grossularia*.

As the gooseberry is a native of Canada and is found growing wild almost or quite to the Arctic circle, its culture will no doubt be extended very far north.

There is a steady though limited demand for gooseberries in Canada, but the gooseberry has never been generally popular in this country. In England gooseberries are used in great quantities for eating out of hand and for jam; in Canada few are used raw, most of the fruit being put into pies, or used as jam, or canned.

Soil, Planting and Culture.

The gooseberry is a moisture-loving plant, hence a soil should be chosen where there can be a constant supply of water during the growing season. In dry soils gooseberries suffer very much in a dry time, the foliage often falling prematurely and the fruit being scalded by the sun. The soil should be a cool one. Moist soils are usually this, but the surface of a sandy loam soil gets very hot in summer, hence it is not the best for this fruit. Well drained, heavy clay loams are the most suitable for

gooseberries as these usually are cool and moist. The soil should have abundant plant food easily made available. A good application of well rotted manure thoroughly worked into the soil will do much to bring about these favourable conditions. The soil should be well prepared and made mellow as for a crop of roots. As gooseberries start to grow early in the spring it is usually preferable to plant in the autumn, and as the leaves drop early they may be planted in September and will be in good condition when winter comes. Well rooted cuttings or layers may be used as plants. They should be set in rows about six feet apart and four feet apart in the rows.

Cultivation should be very thorough so as to retain moisture and keep the soil cool, and as the gooseberry roots near the surface, cultivation should be shallow; mulching with straw is sometimes advisable to keep the soil cool.

As the gooseberry makes much more wood than it is desirable to leave, severe pruning is necessary. English varieties are usually trained to a single stem, but this is not necessary, although the freer circulation of air when trained in this way helps to prevent the spread of mildew.

The usual custom in America is to grow the gooseberry in bush form. The bush should at first be brought into a good shape by leaving a few of the strongest shoots regularly distributed to make an open head. Five or six of these shoots are quite sufficient to leave at first. As the bush gets older, new shoots are allowed to grow to take the place of the older ones, as the pruning should be done with a view to having only vigorous bearing wood. Fruit is borne on year old wood and from spurs on older wood. It is usually not desirable to have any wood more than three years old. The best time to prune is in the autumn or winter. The weakest young shoots should be cut off at the ground, also all the strong young shoots not required for fruiting or to take the place of older branches to be cut away. The side shoots from older branches should be headed back or cut out altogether so as to maintain a fairly open head, making it as easy as possible to pick the fruit and yet leaving sufficient wood to produce a good crop and to shade the fruit from the sun, as in a hot dry time gooseberries are liable to be injured by scalding. When branches are more than three years of age they should be removed to make way for younger wood. It is advisable to cut out all branches which touch the ground as there will then be a better circulation of air, and the fruit will be kept off the ground. Gooseberries will often begin to bear the second year after planting, but there will not be a full crop until the fourth season. If the soil is kept in good condition by an annual application of well rotted barnyard manure in the autumn, harrowed in the following spring, and if the bushes are kept sprayed and well pruned, the plantation will not need to be renewed for many years.

Yield of Gooseberries.

The American gooseberry is a productive fruit and averages a good crop if well cared for. It is, however, very important to have good foliage to protect the fruit from the sun, and unfortunately many let the currant worm destroy a large proportion of the foliage, and if the weather is hot the fruit suffers. Six bushes of Pearl gooseberry have averaged in five years at the rate of 12,102 lbs. per acre per year, or at 60 lbs. to the bushel, over 319 bushels per acre. The highest individual yield was

in 1905, when five bushes of Pearl, six by four feet apart, yielded 75 lbs., or at the rate of 27,225 lbs. per acre, equal to over 680 bushels per acre.

The highest yield mentioned by Card in his work on Bush Fruits, is at the rate of 450 bushels per acre, obtained at the Geneva Experiment Station, N.Y. He gives the probable range from 300 to 500 bushels per acre. Bailey gives the average as 100 bushels per acre, but we believe this is much below what is grown in Canada.

Varieties of Gooseberries Recommended.

American.—Pearl, Downing, Red Jacket (Josselyn).

English (from experience at the Central Experimental Farm).—Companion, Eagle, Glenton Green, Queen of Trumps, Snowball.

English varieties usually recommended.—Whitesmith, Industry

Propagation.

Gooseberries may be propagated either from cuttings or by layering. The average person will usually get the best results from layering, as cuttings are often very unsatisfactory. To propagate by layering, the bushes should be pruned severely in the autumn. This will induce a strong growth of young shoots the next season. When these have made most of their growth, which will be in July, the earth is heaped up around and through the bush until only the tips of the young shoots are left uncovered. The soil is packed down and then a covering of loose soil thrown over to retain moisture better. Most of the American varieties will have rooted well by autumn, and the young plants may be detached and planted in nursery rows either the same fall or the following spring, to be grown there for one season. English varieties usually take two years to root, and the soil must be left about the bushes for that time. Cuttings of American varieties will sometimes give fairly satisfactory results if made from well ripened wood and treated as currant cuttings. The cuttings are made six to eight inches or less in length, and buried in the soil over winter. In spring they are set out in nursery rows, planting deep enough so that only one or two buds are above the ground. Both American and English varieties may be propagated from green wood cuttings in a greenhouse, or bothed with bottom heat.

Scalding of the Fruit.

In a very hot, dry time gooseberries are often scalded, become unfit for use and fall to the ground. If the gooseberries are planted in heavy, cool soil and the ground kept well cultivated and the sawfly prevented from eating the foliage there will be little trouble. Unfortunately in many plantations the foliage is very scant, either on account of poor cultivation or injury from the worm of the sawfly, and it is under such conditions that the greatest injury occurs.

Gooseberry Mildew. The gooseberry mildew has prevented the general culture of the English gooseberry in America. This disease attacks the leaves, twigs and fruit. When the attack is bad it destroys the foliage, covers the fruit and causes most of it to drop. It saps the growing shoot to such an extent that they do not ripen properly, and dry up without setting fruit buds. It thus practically destroys the crop.

The disease is apparent early in the season in the web-like covering which coats the leaves, shoots and fruit. This is the mycelium from which is given off the spores which propagate this disease. It is usually noticed first in the lower and most shaded parts of the bush. When the spores are being given off, the mildew has a powdery appearance. Winter spores are formed later, which germinate in the spring. As the mycelium and spores are both on the surface it might be thought this disease could be easily controlled, but the weather conditions in this country seem so favourable to the development of spores that the gooseberry mildew spreads with great rapidity, and constant and thorough sprayings are necessary to prevent it from doing so. American varieties are seldom affected by gooseberry mildew, although occasionally they are slightly attacked.

Remedy.—First application.—Copper sulphate or lime-sulphur wash, just before leaves open.

Second application.—Poisoned Bordeaux or potassium sulphide (1 oz. to 2 gallons water), or lime-sulphur wash, just before flower buds open.

Third application.—Bordeaux with hellebore, lime-sulphur wash or potassium sulphide, when fruit has set. (Important.)

Fourth application.—Lime-sulphur wash, or potassium sulphide, ten days later, if necessary.

Leaf Spot Rust.—The disease which causes the spotting of the leaves and their premature falling is the same as that which affects currants, and may be dealt with in the same way.

Currant Worm.—See under currant.

Gooseberry Fruit-worm.—Just before gooseberries ripen, clusters of two or three may sometimes be noticed, which are prematurely coloured and which are joined together by the webs spun by the caterpillar of a small moth. These caterpillars are pale greenish-white and sometimes have a reddish tinge. They live inside the berries and, when the contents of one berry are consumed, attack another near at hand, joining it to the first by a silken web. When full grown they fall to the ground and spin parchment-like cocoons just beneath the surface of the ground. The moths, which are pale grey marked with dark streaks and bands, are rarely observed. They fly in the spring, and there is only one brood in the year.

Remedy.—The best remedy for controlling this insect, which fortunately is never very abundant, is to pick by hand the clusters or injured berries. It is claimed that chickens and other poultry are useful in destroying the larva and chrysalids; and it is certain that, while chickens are very small, they are useful in a garden in destroying a great number of injurious insects. The old hen, however, should be kept securely cooped up and not allowed to run at large.

Insecticides.

Paris Green—For foliage-eating insects—

Paris green	1 lb.
Unslaked lime	1 lb.
Water	160 gallons.

Dry Mixture. 1 lb. Paris green with 50 lbs. flour, land plaster, slaked lime or other perfectly dry powder.

Poisoned Bran.—Mix ½ lbs. of Paris green with 50 lbs. of slightly moistened bran.

Arsenate of Lead—For foliage-eating insects.—

Arsenate of lead	3 lbs.
Water	40 gallons.

Mix thoroughly before using.

Hellebore—

White hellebore	1 oz.
Water	2 gallons

Or to be dusted undiluted over the attacked plants.

Kerosene Emulsion—For bark-lice and other sucking insects—

Kerosene (coal oil)	2 gallons.
Rain water	1 gallon.
Soap	½ lb.

Dissolve soap in water by boiling; take from fire, and, while hot, pour in kerosene and churn briskly for five minutes. For use, dilute with 9 parts of water. The above 3 gallons of stock emulsion will make 30 gallons of spraying mixture.

Flour Emulsion—

Kerosene	1 quart.
Flour	8 ozs.
Water	3 gallons.

Stir together the flour and kerosene, then add the water, and churn violently for five minutes. To be used at once.

Whale-oil Soap—

For brown or black aphis	1 lb.	in	4 gallons of water.
For scale insects (young)	1 "	"	5 "
For green aphis or thrip	1 "	"	6 "
For San José scale (in winter)	2 "	"	1 "

Lime-sulphur Wash—For San José scale and fungous diseases—

Lime	20 lbs.
Sulphur, powdered	15 lbs.
Water to make	40 gallons.

Slake the lime with only enough water to do it thoroughly. Add the sulphur by dusting it over the lime while slaking; stir well and boil for at least an hour, adding only so much hot water as is necessary for easy stirring. When thoroughly cooked, strain through sacking, and apply hot.

When concentrated lime-sulphur wash is used it should be diluted for use, when there are no leaves on the trees, to 1 gallon of the concentrated wash to about 9 gallons of water, varying with the density of the wash. For use in summer the lime-sulphur should be diluted to 1 gallon of the concentrated wash to 30 to 35 gallons of water. Arsenate of lead is the best poison to use with the lime-sulphur wash. Arsenite of lime will injure foliage.

Fungicides.

Bordeaux Mixture—For fungi—

Copper sulphate (bluestone)	4 lbs.
Unslaked lime	4 lbs.
Water (1 barrel)	40 gallons.

Dissolve the copper sulphate (by suspending it in a wooden or earthen vessel containing four or five or more gallons of water). Slake the lime in another vessel. If the lime, when slaked, is lumpy or granular, it should be strained through coarse sacking or a fine sieve. Pour the copper sulphate solution into a barrel, or it may be dissolved in this in the first place; half fill the barrel with water; dilute the slaked lime to half a barrel of water, and pour into the diluted copper sulphate solution, then stir thoroughly. It is then ready for use. (Never mix concentrated milk of lime and copper solution.)

A stock solution of copper sulphate and milk of lime may be prepared and kept in separate covered barrels throughout the spraying season. The quantities of copper sulphate, lime and water should be carefully noted. Bordeaux mixture deteriorates with age and should be used as soon as made.

To test Bordeaux mixture let a drop of ferrocyanide of potassium solution fall into the mixture when ready. If the mixture turns reddish-brown add more milk of lime until no change takes place.

Poisoned Bordeaux Mixture—For fungi and leaf-eating insects.—To the 40 gallons of Bordeaux mixture prepared as above, add 4 to 8 ounces of Paris green, or 3 lbs. of arsenate of lead.

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